Efficient Nuclear Pulse Propulsion with Deuterium-Tritium Thermonuclear Micro-Explosions

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Abstract

In deuterium-tritium (DT) fusion reaction, 80% of the energy is released into 14MeV neutrons which cannot be deflected by a magnetic mirror for thermonuclear micro-bomb propulsion. This was the reason why for the Project Daedalus interstellar probe study of the British Interplanetary Society, the neutron poor deuterium-helium3 reaction was chosen. There it is not only required to reach the highest possible specific impulse, but also avoid a large radiator to remove the heat released by neutrons absorbed in the space craft. The problem is there the abundance of the rare helium3 isotope, proposed to mine it from the atmosphere of Jupiter. But for a manned mission inside the solar system, in particular to the planet Mars, no such high specific is needed or even desired. There an exhaust velocity of 30 km/s is sufficient, whereby a trip to Mars would be as small as one week. Here, 80% of the energy released into neutrons can be dissipated in a liquid hydrogen sphere with a radius of ~ 20cm, raising its temperature to ~ 10^5K where the hydrogen is fully ionized and can be deflected by a magnetic mirror with a velocity of ~ 30 km/s. For the ignition of the DT thermonuclear micro-explosion a 10^6 Ampere-GeV proton beam is proposed, generated by using the entire space-craft as a large GeV capacitor, magnetically insulated against an electron cloud in the vacuum surrounding the space craft.

Matter-Antimatter GeV Gamma Ray Laser Rocket Propulsion

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It is shown that the idea of a photon rocket through the complete annihilation of matter with antimatter, first proposed by Sänger, is not a utopian scheme as it is widely believed. Its feasibility appears to be possible by the radiative collapse of a relativistic high current pinch discharge in a hydrogen-antihydrogen ambiplasma down to a radius determined by Heisenberg's uncertainty principle. Through this collapse to ultrahigh densities the proton-antiproton pairs in the center of the pinch can become the upper GeV laser level for the transition into a coherent gamma ray beam by proton-antiproton annihilation, with the magnetic field of the collapsed pinch discharge absorbing the recoil momentum of the beam and transmitting it to the spacecraft. The gamma ray laser beam is launched as a photon avalanche from one end of the pinch discharge channel.